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MISCELLANEOUS NOTES

1. A NOTE ON WHISTLE ALARM CALLS OF THREE-STRIPED PALM SQUIRREL *FUNAMBULUS PALMARUM* LINNAEUS IN SITAMATA WILDLIFE SANCTUARY, RAJASTHAN, INDIA

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Alarm calls are vocalizations by an animal that can alert other animals of impending danger (Mateo and Holmes 1997). Among group-living animals, alarm calls would thus be expected to improve chances of evading an approaching predator (Schwagmeyer 1980). Sherman (1985), Lair (1990), Melchior (1971), Owings *et al.* (1986), Leger and Owings (1978), Smith (1978), and Zelley (1971) have studied many aspects of vocalization of ground and tree squirrels, but no work is available on vocalization of Indian species. Babu and Jayson (2009) have used call playback of conspecific owls in the forest of Tamil Nadu and Kerala to detect the presence of Indian Giant Flying Squirrel *Petaurista philippensis.* When owl calls were played back, the squirrel exposed itself by its characteristic calls. Rajamani (2001) studied some aspects of calls of the Small Travancore Flying Squirrel *Petinomys fuscocapillus* and Indian Giant Flying Squirrel *P. philippensis.* Though a few studies on flying squirrels are available, no work is available on vocalization in non-flying striped squirrels of India.

The Three-Striped Palm Squirrel *Funambulus palmarum* Linn. is found only in dense forests of southern Rajasthan. Its presence was recently reported by Sharma (2005, 2007) in the State. Not much work has been done on this species in Rajasthan. No information is available on vocalization of this squirrel. This is probably the first study on vocalization of *F. palmarum.*

On March 15, 2010, while wandering in Sitamata Wildlife Sanctuary, near Rana forest outpost, we noticed *F. palmarum* on a giant Mahua tree *Madhuca indica.* Since we had approached suddenly the squirrel started vocalizing alarm calls, probably out of fear. It was repeatedly calling while clinging to the upper surface of a horizontal bough. We captured its voice on a digital camera. The recorded sound was separated using Total Video Converter software into a

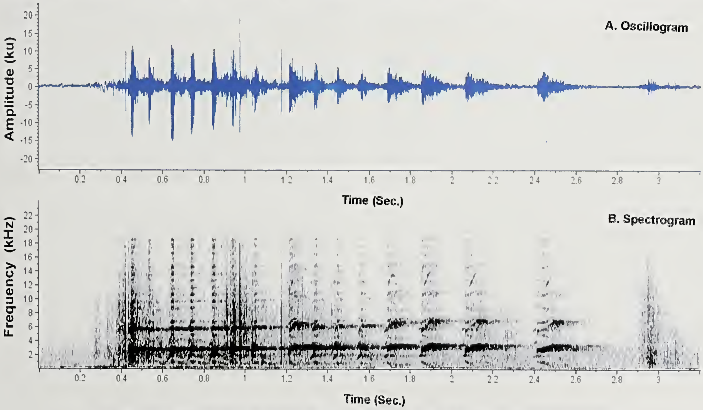

Fig. 1: Oscillogram (A) and Spectrogram (B) of one whistle alarm call bout of *Funambulus palmarum.* Each straight band represents a whistle alarm call

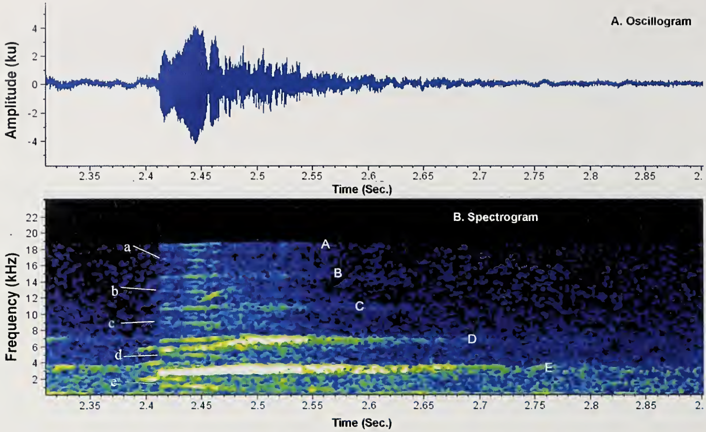

Fig. 2: Oscillogram (A) and Spectrogram (B) of one whistle alarm call of *Funambulus palmarum*. Spectrogram shows two type of bands; narrow bands (a, b, c, d and e) and broad bands (A, B,C, D and E)

wave audio file and analyzed with the help of the software Raven Pro 1.4.

On analysis, it was revealed that the whistle alarm call sounds consisted of a series of calls, which began and ended abruptly (Fig. 1). A total of 14 calling bouts were recorded; a few (n = 4) when *F. palmarum* ran along a tree bough. Mean call numbers of call bouts was 15 ±2.219 SD (max 20 and min 12). Mean duration of call bouts was 3.25 ±1.89 SD sec (min 1.60 sec and max 8.7 sec), and mean interval between calling bouts was 5.09 ±3.49 SD seconds (min 1.50 sec and max 12 sec). At the onset of a call bout, the first few calls were a high amplitude and towards the end, the amplitude of the calls became low (Fig. 1). Duration of calls was short initially and increased subsequently. Mean interval between two calls was 0.012 (±0.004 SD, n = 210) seconds and it increased in the last segment of the call bout. The last two calls contained the highest call duration (mean 0.35 ± 0.008 SD sec, n = 14).

The most pronounced characteristics of the calls are their harmonic nature. The call structure of *F. palmarum* contains variable flat bands in their spectrogram with variable duration (Fig. 2). A call spectrogram consists of a paired and periodic trajectory harmonics. Two type bands are present in the whistle alarm call spectrogram of *F. palmarum* – broad bands (A, B, C, D and E) and narrow bands (a, b, c, d and e). They are present in an alternative form. Duration of all narrow bands is 0.05 sec, but that of broad bands varies from 0.15-0.35 sec. The frequency range of one call is 1 to 18.5 Hz. Narrow bands are present on 1 (e), 5(d), 9(c), 13(b) and 17 kHz (a); broad bands are present on 18.5(A), 15(B), 11(C), 7(D) and 3(E) kHz in the spectrogram (Fig. 2).

The present study describes a type of alarm call of *F. palmarum*. Further studies are required on the vocalization and calls structure of this species, as it will help understand the communication pattern and social organization in tree dwelling squirrels.

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2. ON A RECORD SPECIMEN OF GREY-HEADED GIANT FLYING SQUIRREL *PETAURISTA CANICEPS* GRAY, FROM ARUNACHAL, PRADESH WITH A NOTE ON ITS TAXONOMY

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The genus *Petaurista* is the most diverse among the flying squirrels. It has seven recognized species in India. These are the Red or Common Giant Flying Squirrel *Petaurista petaurista*, Indian Giant Flying Squirrel *P. philippensis*, Grey-headed Giant Flying Squirrel *P. caniceps*, Hodgson's Giant Flying Squirrel *P. magnificus*, Bhutan or Orange Giant Flying Squirrel *P. nobilis*, Mechuka Giant Flying Squirrel *P. mechukaensis* and Mishmi Hills Giant Flying Squirrel *P. mishmiensis*. However, a stable taxonomy for the giant flying squirrels of the genus *Petaurista* Link, 1795 remains elusive mainly owing to lack of sufficient specimens (as many of them live in remote mountains with difficult accessibility, hence, relatively fewer collection of several species). This is evident from the fact that two new species have been described recently from Arunachal Pradesh (Choudhury 2007, 2009a, b). I here report of a specimen of Grey-headed Giant Flying Squirrel *P. caniceps* Gray, from the same state, which appeared to be much larger than it is known.

P. caniceps was described from a specimen obtained in Nepal (Gray 1842). Ellerman and Morrison-Scott (1966) and Hoffmann *et al.* (1993) included it in *P. elegans*. It was reviewed by Corbet and Hill (1992) who upgraded it to a full species level. Ellerman (1961), while including it in *P. elegans*, had also considered the following forms as subspecies of *P. elegans* – *clarkei* and *gorkhali*, which are now synonyms of *caniceps*. The maximum total length recorded for *caniceps* was 77 cm with tail slightly longer than head-and-body (Corbet and Hill 1992).

In November 2002, I examined a skin of a male, which was killed about 2-3 months ago at Mechuka (28° 36' N; 94° 08' E) in West Siang district, Arunachal Pradesh. The elevation of Mechuka is 1,900 m above msl. The specimen measured 86 cm (total length, up to hair-tip at tail-end). Although it was in excellent condition, the head-and-body and tail lengths could not be measured separately with accuracy, as in flying squirrels the interfemoral membrane makes it difficult to determine the base of the tail unless the bone at the base remains intact (in this case the bone was absent).

It had a conspicuous grey head with a light rufous 'ring' around the eyes and a rich rufous patch around (posteriorly) the ears. Cheeks are also grey. There was a narrow black patch above the nose. Nostrils were light grey with a blackish median line. Dorsally it was almost uniform rufous brown. Black-tipped hairs could be seen anteriorly. Base of hair grey, which was prominent on the dorsum. Sides of parachute and upper portion of limbs were uniform rich rufous. Tail was similarly coloured as dorsum, but a black tip and an irregular line almost up to the base were noteworthy.

Ventrally, it was light rufous-buff with a slightly darker rufous median line from throat to lower abdomen. Parachute was rich rufous. Throat was conspicuous white while lower abdomen including genital region looked grey with buff. Tail was similarly coloured as dorsa, also with a black tip and an irregular line. On closer examination, some hairs in the anterior half of the tail had black at the centre with rufous